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Remarks

AU Ser. No. 2002953089
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SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Louis F. Wagner
Signature	
Date	January 7, 2004

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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2002953089 for a patent by THOMAS ANTHONY MEYERS as filed on 04 December 2002.

WITNESS my hand this
Twenty-eighth day of November 2003

LEANNE MYNOTT
MANAGER EXAMINATION SUPPORT
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AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

Invention Title: "IMPROVEMENTS IN EXCAVATOR TEETH"

The invention is described in the following statement:

TITLE

"IMPROVEMENTS IN EXCAVATOR TEETH"

FIELD OF THE INVENTION

This invention is concerned with improvements in excavator teeth for earth excavating devices.

The invention is concerned particularly, although not exclusively, with the mounting of excavator teeth adaptors to adaptor noses on an excavating device such as an excavator bucket or the like.

BACKGROUND OF THE INVENTION

Excavating teeth mounted to the digging edge of excavator buckets and the like generally comprise a replaceable digging point, an adaptor body and an adaptor nose which is secured by welding or the like to the digging edge of a bucket or the like. The adaptor has a socket-like recess at its rear end to receivably locate a front spigot portion of the adaptor nose and a locking pin extends through aligned apertures in the adaptor and nose to retain the adaptor in position.

In use, excavator teeth are subjected to extensive load forces along a longitudinal axis of a tooth as well as in vertical and transverse directions. A snug fit is required between the digging point and the front portion of the adaptor and also between the adaptor socket and the nose spigot portion and their respective mounting pins to avoid premature wear between the components. As the various components wear, the locking pins can loosen thereby increasing the risk of loss of a digging point or an entire digging tooth assembly.

The greatest loads experienced by excavator teeth ar_ vertical loads which tend to generate large moment forces capable of rotating a tooth off the front of an adaptor and/or rotating the adaptor off the adaptor nose.

Despite many prior art attempts to improve the mounting of an adaptor to a nose, most of these proposals suffer from one or more deficiencies.

United States Patent No 4,182,058 describes an excavator tooth having a rearwardly divergent tapering socket to receive a nose having a complementary-shaped front spigot portion. Resistance to rotational moment forces is borne by a resilient steel cotter pin extending through aligned vertical apertures in the socket and spigot portions.

United States Patent No 3,023,521 also describes an excavator tooth having a rearwardly divergent tapering socket to receive a complementary-shaped tooth support spigot portion. Rotational moment forces are resisted by a lip engaging in a recess in the tooth support member.

United States Patents 3,774,324, 4,338,736, 4,481,728 and 4,903,420 all describe nose and tooth combinations wherein the nose has a generally convergently tapering spigot portion with a forward tip having a box-like configuration with at least the upper and lower surfaces thereof having faces parallel to each other and to a longitudinal axis of the nose portion. With the exception of Patent No 4,338,736, which describes a transverse locking pin, each of the tooth mounting arrangements is heavily reliant on a large v rtical locking pin to resist rotational moment forces

tending to rotate the teeth off respective noses.

United States Patent No 4,231,173 describes a tapered adaptor nose having a box-like free end, which engages in a mating box-like socket cavity to resist rotational moments. Opposed pairs of rearwardly extending tongues engage in corresponding recesses in the outer surfaces of the adaptor nose to resist rotational movements. Because the tongues themselves are unsupported, they possess a limited capacity to resist rotational moment forces.

United States Patent No 5,272,824 describes a structure similar to that of United States Patent No 4,231,173 except that the side tongues are of more robust dimensions and the upper and lower tongues are formed as box-like members with apertures to receive a vertical mounting pin passing through aligned apertures in the tooth and adaptor nose.

United States Patents 3,196,956 and 4,404,760 provide flat rail surfaces on the adaptor nose to engage with mating grooves in the socket aperture of a corresponding tooth. In the case of Patent No 3,196,956, the mating rail and groove surfaces are forwardly tapered, whereas in Patent No 4,404,760 the mating rail and groove surfaces are generally parallel to the longitudinal axis of a tooth.

United States Patent No 5,423,138 describes a generally tapered nose having a box-like front end with upper and lower transverse surfaces generally parallel to a longitudinal axis of a tooth. The parallel upper and lower transverse surfaces are contiguous with upper and lower rail surfaces on each sid of the nos and parallel to th longitudinal axis of the

tooth. A pair of rearwardly extending side tongues locate in recesses formed in the outer side faces of the nose, ostensibly to resist rotational moment forces in the tooth. Because the side tongues are recessed to accommodate the side rail portions, the robustness of the side tongues is somewhat compromised.

United States Patent No 4,233,761 describes a fairly stubby tapered nose having a box-like front portion with upper and lower surfaces generally parallel to a longitudinal axis of an excavator tooth, an intermediate rearwardly diverging tapered portion and a rear portion having upper and lower surfaces extending generally parallel to a longitudinal axis of the tooth. Formed on the upper and lower surfaces of the front, intermediate and rear portions of the nose are spaced parallel reinforcing ribs which are located in mating grooves in the excavator tooth. A large vertical locking pin extends through aligned apertures in the tooth and nose between the reinforcing ribs. This structure is heavily reliant on the locking pin to resist rotational moment forces however it is considered that this configuration may be prone to failure in the rear portion of the adaptor.

United States Patent No 5,709,043 describes a nose/adaptor combination wherein the adaptor socket tapers convergently towards a box-like front portion having upper and lower bearing surfaces generally parallel to a longitudinal axis of the tooth, a front transverse upright bearing surface and rearwardly divergent bearing surfaces formed at obtuse angles between the converging upper and lower walls and the side walls of the socket, ostensibly to avoid areas of stress concentration.

While generally satisfactory for their intended purpos , th abovementioned prior art adaptor/nose combinations all suffer from one or more shortcomings or disadvantages in terms of inadequate resistance to rotation of an adaptor off a nose under the influence of vertical loads applying a rotational moment to the adaptor, a predisposition to premature wear, difficulties in retention of the adaptors on noses, inadequate locking systems and unduly complicated configurations giving rise to increased fabrication costs.

It is an aim of the present invention to overcome or alleviate at least some of the abovementioned prior art disadvantages or otherwise to provide consumers with a convenient choice.

SUMMARY OF THE INVENTION

According to one aspect of the invention there is provided an excavator tooth system comprising:-

a mounting nose having a projecting spigot; and,

a wear member having at one end thereof a socket, said socket being defined by spaced side walls and upper and lower walls converging from a rearwardly facing socket opening to a forward end of said socket, each of said upper and lower walls comprising a forward bearing face and a rear bearing face separated by a forwardly convergent intermediate face, said front and rear bearing faces being substantially parallel to a longitudinal axis of said wear member.

Suitably, said forward end of said socket forms an end bearing face.

If required, said end bearing face may extend transversely of said longitudinal axis.

The wear member may comprise an excavator tooth having a digging edge at a front end thereof.

Preferably, the wear member comprises an adaptor having a front end adapted for releasable attachment of a digging point.

Suitably, said wear member includes an aperture in at least one wall of said socket.

Preferably, said wear member includes aligned apertures on opposite walls of said socket.

If required, said aligned apertures may extend through upper and lower socket walls.

Preferably, said aligned apertures extend through opposite side walls of said socket.

If required, at least portion of said rear bearing face is of a width greater than said forward bearing face.

At least portion of said rear bearing face may be of substantially a similar width to said forward bearing face.

Suitably, said rear bearing face is of an area greater than said forward bearing face.

The socket opening may have a transverse width grater than the width of the forward end of said socket.

If required, the side walls of said socket may taper convergently towards said forward end of said sockets.

Alternatively, the side walls of said socket may be stepped.

According to another aspect of the invention there is provided an excavation device having an excavator tooth system according to a first aspect of the invention and wherein said mounting nose is integrally formed with said excavation device.

Alternatively, said mounting nose may be attached to said excavation device.

According to a further aspect of the invention there is provided a lip for an excavation device said lip having a plurality of spaced mounting noses for excavator tooth systems according to a first aspect of the invention.

Suitably, said mounting noses are attached to said lip.

Preferably, said mounting noses are integrally formed with said lip.

If required, said lip may include wear plates releasably secured between adjacent mounting noses.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be more fully understood and put into practical effect, reference will now be made to the accompanying drawings in which:-

FIG. 1 shows portion of an adaptor nose;

FIG. 2 shows an exploded view of an excavator tooth system according to one aspect of the invention.

FIG. 3 shows schematically an upright cross-s ctional vi w

showing the engagement between a mounting nose and an adaptor according to the invention.

FIG. 4 shows in transverse cross-section a locking pin for releasable attachment of the adaptor to the mounting nose;

FIG. 5 shows in transverse cross-section the locking pin of FIG. 4 in a locked position;

FIG. 6 shows schematically a transverse cross-sectional view of an excavator tooth system according to one aspect of the invention;

FIG. 7 shows a lip for an excavation device in accordance with another aspect of the invention;

FIG. 8 shows an exploded view of the lip of FIG. 7 and excavator teeth systems according to one aspect of the invention; and

FIG. 9 shows the arrangement of FIG. 8 in an assembled state.

DETAILED DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, for the sake of clarity, like reference numerals are employed for like features where appropriate.

In FIG. 1, the mounting nose 1 is shown as integrally formed with a cutting lip 2 of an excavation device such as a dragline bucket or the like (not shown).

Nose 1 includes a pair of opposed generally parallel side faces 3, a front face 4 and upper and lower faces 5,6 converging towards front face 4. Upper and lower faces 5, 6 each include rear bearing faces 7 and forward bearing faces 8 separated by a tapered generally planar intermediate face 9. Rear bearing faces 7, forward b aring fac s 8 and front bearing faces 10 are

all shown as shaded regions for the sake of clarity.

Rear bearing faces 7 are parallel to each other as are forward bearing faces 8. Each of rear and forward bearing faces 7,8 are also parallel to a longitudinal axis X of the mounting nose 1.

Extending transversely of mounting nose 1 is an adaptor mounting aperture 11. Aperture 11 is generally oval in cross-sectional shape with the longer oval axis extending generally parallel to nose axis X. Aperture 11 is positioned closer to top face 5 than bottom face 4, the purpose of which positioning will be described in detail later.

In a conventional tapered wedge-shaped adaptor nose there is a substantial rotational moment to a digging point in the region of the adaptor tip. This rotational moment force is resisted by normally directed forces in the rear of the upper and lower wedge faces and frictional forces in the upper wedge face. If the rotational moment is small compared with the normally directed forces on the upper wedge face, the frictional forces produced by the normally directed forces can be sufficient to withstand the rotational moment. For a digging point this usually is the case because as the moment force on the digging point is applied almost directly above the upper face of the wedge, the moments are small compared to the normal forces and the corresponding frictional forces are sufficient to retain the digging point in place.

In the case of the mounting between a wedge-shaped adaptor nose and the adaptor itself, the frictional forces are insufficient to withstand the rotational mom nt to pr vent the adaptor from simply rotating off th

nose under load. To overcome this it is customary with wedge-shaped adaptor noses to employ a substantial pin to retain the adaptor in place as the pin must withstand very large forces applied thereto. Typically, this necessitates a vertically oriented pin.

In the present invention, the key bearing faces are configured to be generally parallel to the longitudinal axis of a wear member such as an adaptor. The wear member is thus cantilevered on the nose whereby the rotational moment is resisted by the high load forces applied to the upper forward bearing face and the lower rear bearing face. Generally speaking the higher those load forces, the higher the friction available to hold the adaptor or wear member onto the nose. Because the bearing faces are substantially parallel, an adaptor cannot rotate off its nose.

The excavator tooth system according to the invention in effect becomes self-locking by virtue of its high internal frictional forces. As a consequence, the role of the retaining pin is substantially reduced from being a major structural component in prior art systems to being a device which simply stops the wear member from falling off a nose.

FIG. 2 shows an exploded view of an excavator tooth assembly according to one aspect of the invention.

As shown, the assembly comprises a mounting nose 1 (shown partially), an adaptor 12 and a replaceable digging point 13.

Adaptor 12 includes a hollow recess or socket (not shown) to receive the nose 1. Adaptor 12 is retained on nose 1 by a spool and wedge pin 14 which extends through oval-shaped apertur s 15 in the adaptor body

when aligned with aperture 11 in nose 1. Point 13 is releasably retained on the front tip of adaptor 12 by a retaining pin (not shown) extending through aligned apertures 16,17 in the point 13 and adaptor 12 respectively.

FIG. 3 is a schematic vertical cross-sectional view through the nose 1 and adaptor 12 of FIG. 2 and shows the engagement of the bearing surfaces of the nose and adaptor.

When the spool and wedge pin 14 is tensioned nose 1 is firmly located in the socket cavity 18 of adaptor 12 with the front bearing face 10 of nose 1 in abutment with corresponding bearing face 10a in adaptor 12. Similarly, rear and forward bearing faces 7 and 8 are abutted against corresponding bearing faces 7a,8a respectively in adaptor 12.

FIG. 4 is a partial schematic transverse cross-sectional view through the nose/adaptor combination shown in FIG. 3.

As shown, spool and wedge retaining pin 14 is in an extended unlocked position with the shoulders 20 of pin body 21 being located behind the rear inner edges of apertures 15. A threaded bolt 22 is rotatably journalled in one end of pin body 21 and its other end is engaged in a threaded aperture 23 in wedge member 24. As bolt 22 is rotated, it draws wedge member 24 into the aligned apertures 15,11 of adaptor 12 and nose 1 respectively until it wedges adaptor 12 into tight engagement with nose 1 as shown in FIG. 5.

As can be seen in FIG. 5, retaining pin 14 is in a retracted locking position with the free ends thereof slightly recessed into apertures 15.

FIG. 6 shows a sch matic transvers cross-sectional vi w

through the assembly of FIG. 2 when in an assembled state.

FIG. 7 shows another aspect of the invention.

Depicted is a cutting lip 30 of an excavation device such as a dragline bucket (not shown).

Cutting lip 30 is cast as an integral component from a suitably wear resistant metal alloy and comprises a transverse cutting bar 31, cheek plates 32 and mounting noses 1 at spaced intervals therealong.

Noses 1 are faired back into cutting bar 31 forming recessed regions 33 between adjacent noses. At the front portion of each cheek plate 32 are mounts 34 for attachment of replaceable cutting edges (not shown).

FIGS. 8 and 9 respectively show an exploded view and an assembled view of the cutting lip 30 of FIG. 7 with adaptors 12 and digging points 13 of FIG. 2.

In the assembly of FIG. 9, lip shrouds 35 are removably secured in the recessed regions of bar 31 to minimize wear on the lip assembly. As can be seen from FIG. 9 and also from FIGS. 1 and 3, the aligned pin apertures 11,15 of nose 1 and adaptor 12 respectively are displaced vertically upward relative to a transverse plane occupied by the longitudinal axis X as shown in FIG. 1, which axis lies in a central plane of nose 1. By having the mounting apertures offset from a central position, the retaining pins can be removed or installed without needing to remove the lip shrouds 34. In turn, this permits the face of the lip shroud 35 to be located at its optimal position with the face of the shroud running along the centre line of the tooth assembly.

It readily will be apparent to persons skilled in the art that many variations and modifications may be made to the invention without departing from the spirit and scope of the invention.

For example, as the key digging forces are taken up by the socket and spigot fitting between the nose and the wear member or adaptor; the retaining pin can be of any design as it functions merely to hold the wear member in place on the nose and otherwise does not constitute a load bearing member.

While resilient plugs may be employed to plug the locking pin apertures to stop ingress of particulate matter which might otherwise constitute an abrasive material, entry of dirt into the small spaces between the flat faces of the socket and spigot members of the assembly tend to pack tightly and actually prevent relative movement between the nose and the wear member thus reducing, rather than increasing, internal wear between components.

Throughout this specification, unless the context requires otherwise, the word "comprise", and variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers or steps but not the exclusion of any other integer or group of integers.

DATED this Fourth day of December 2002.

THOMAS ANTHONY MEYERS

by his Patent Attorneys

FISHER ADAMS KELLY

FIG 1

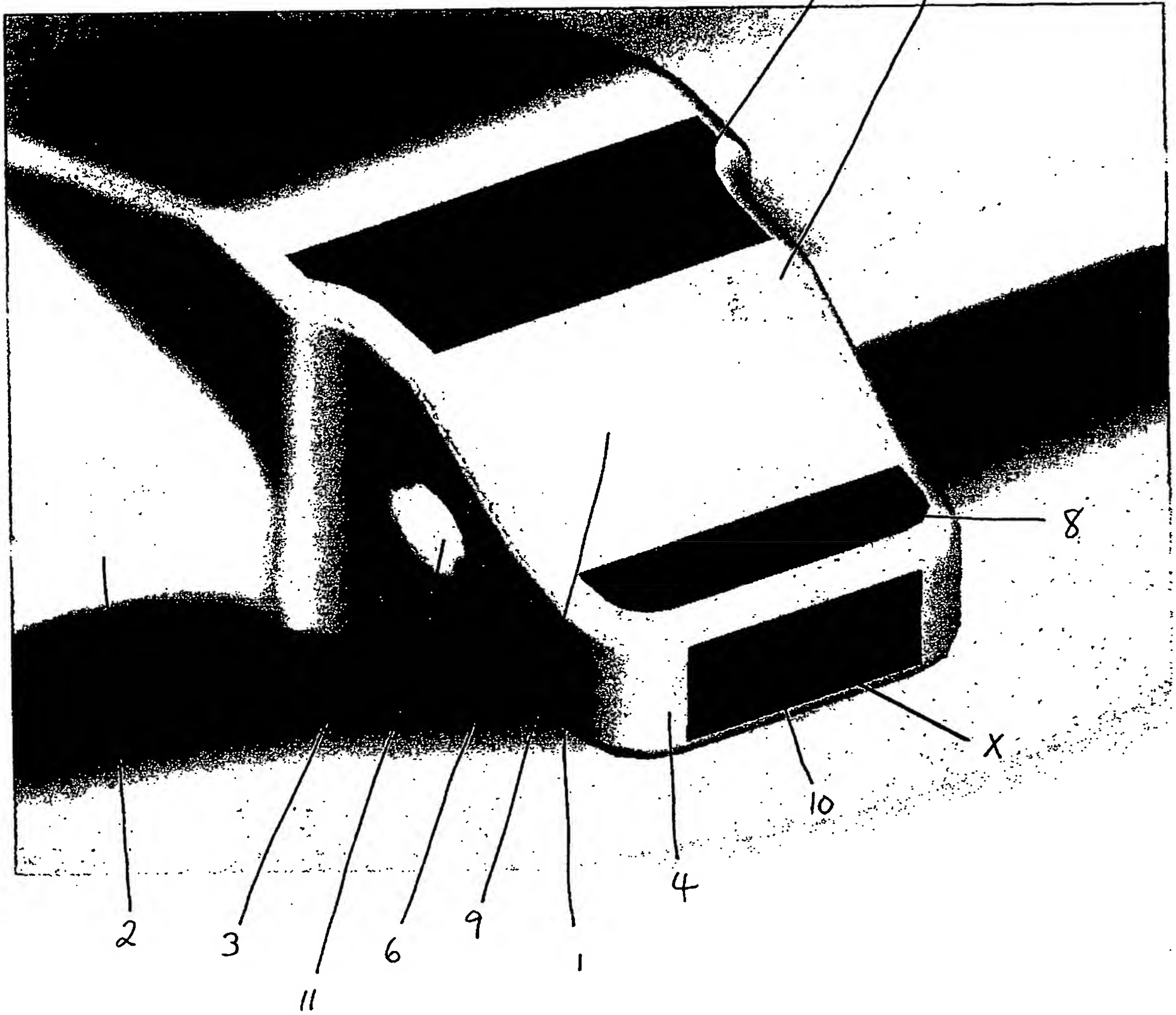
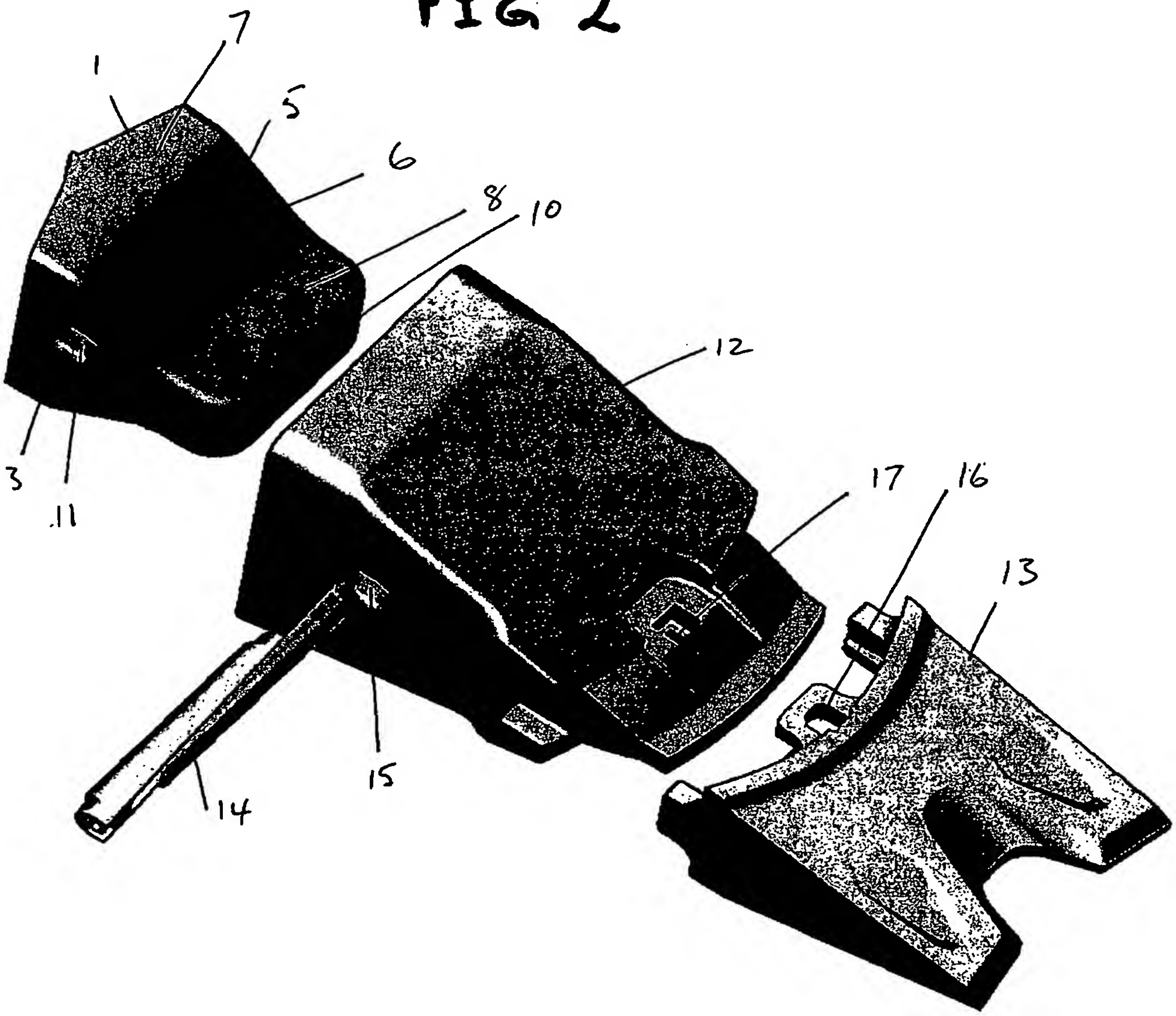


FIG 2



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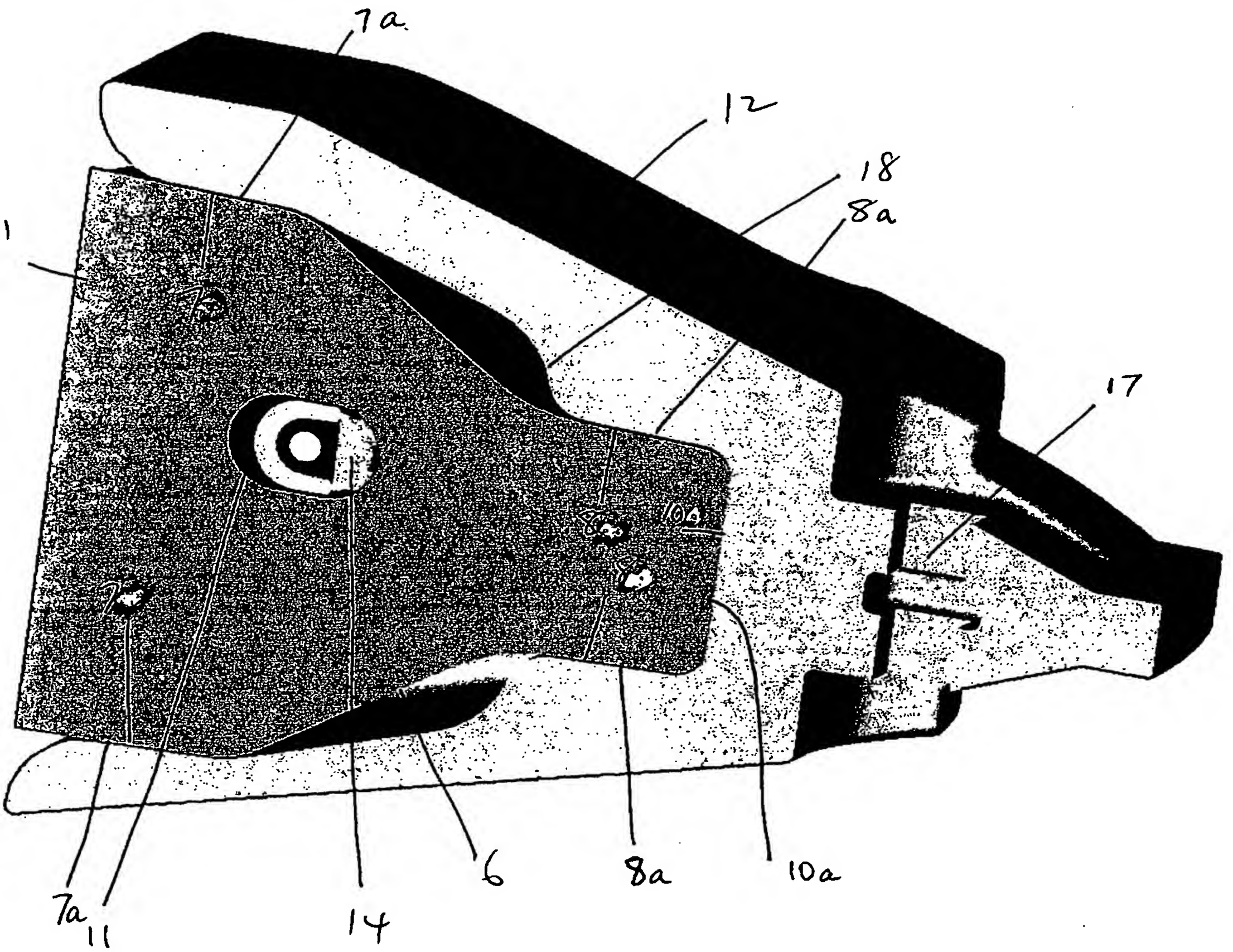

FIG 4

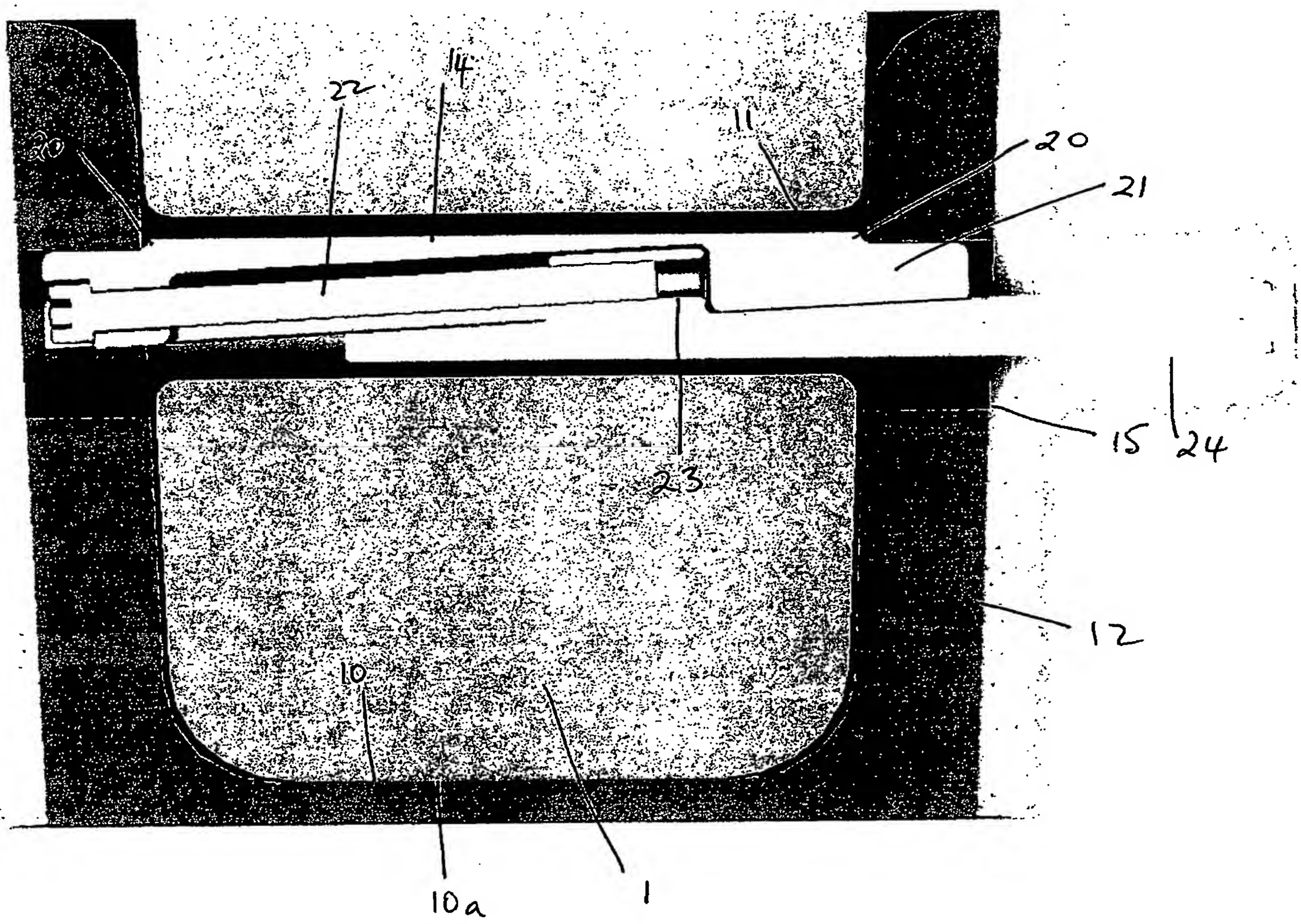

FIG 5

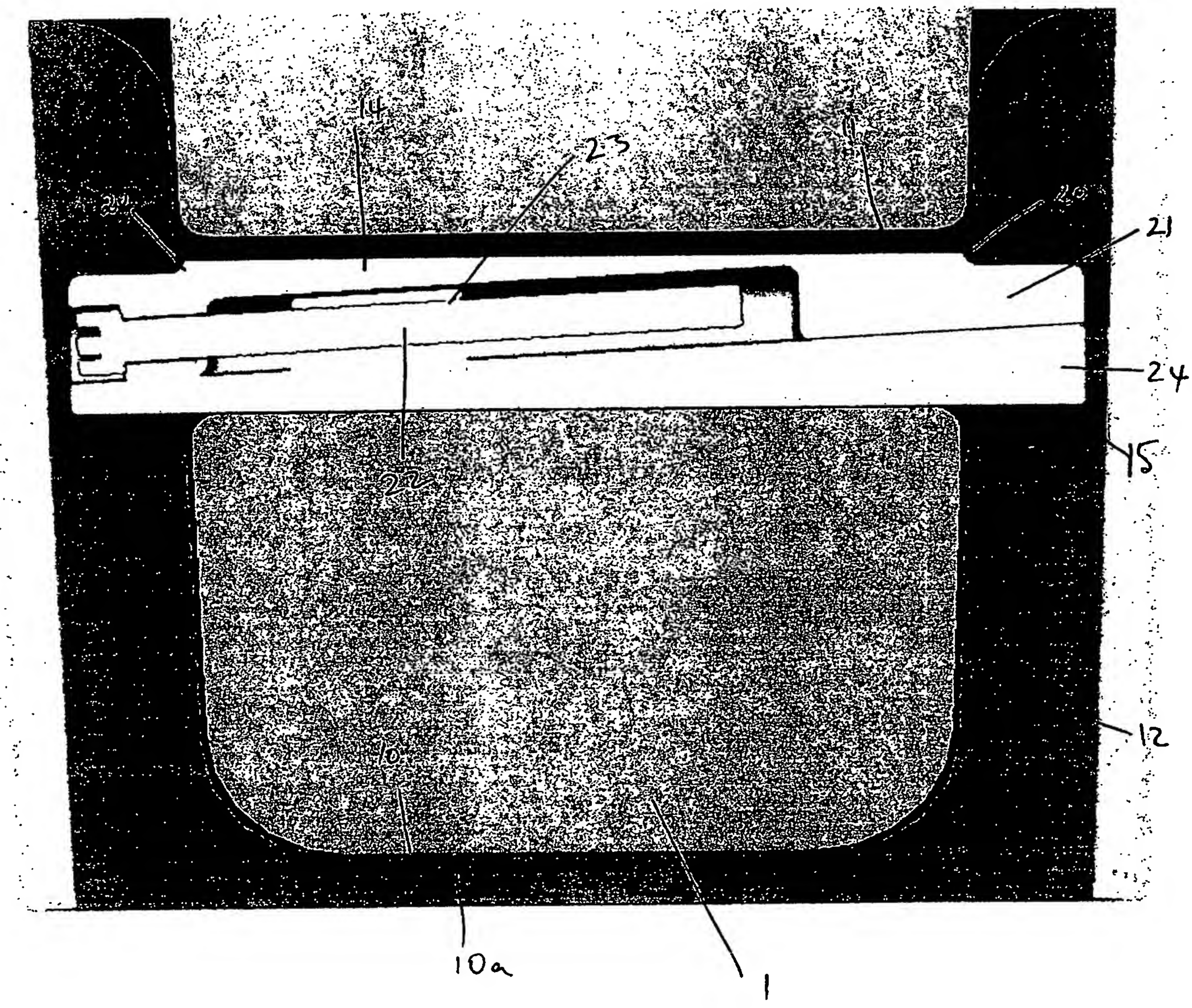

FIG 6

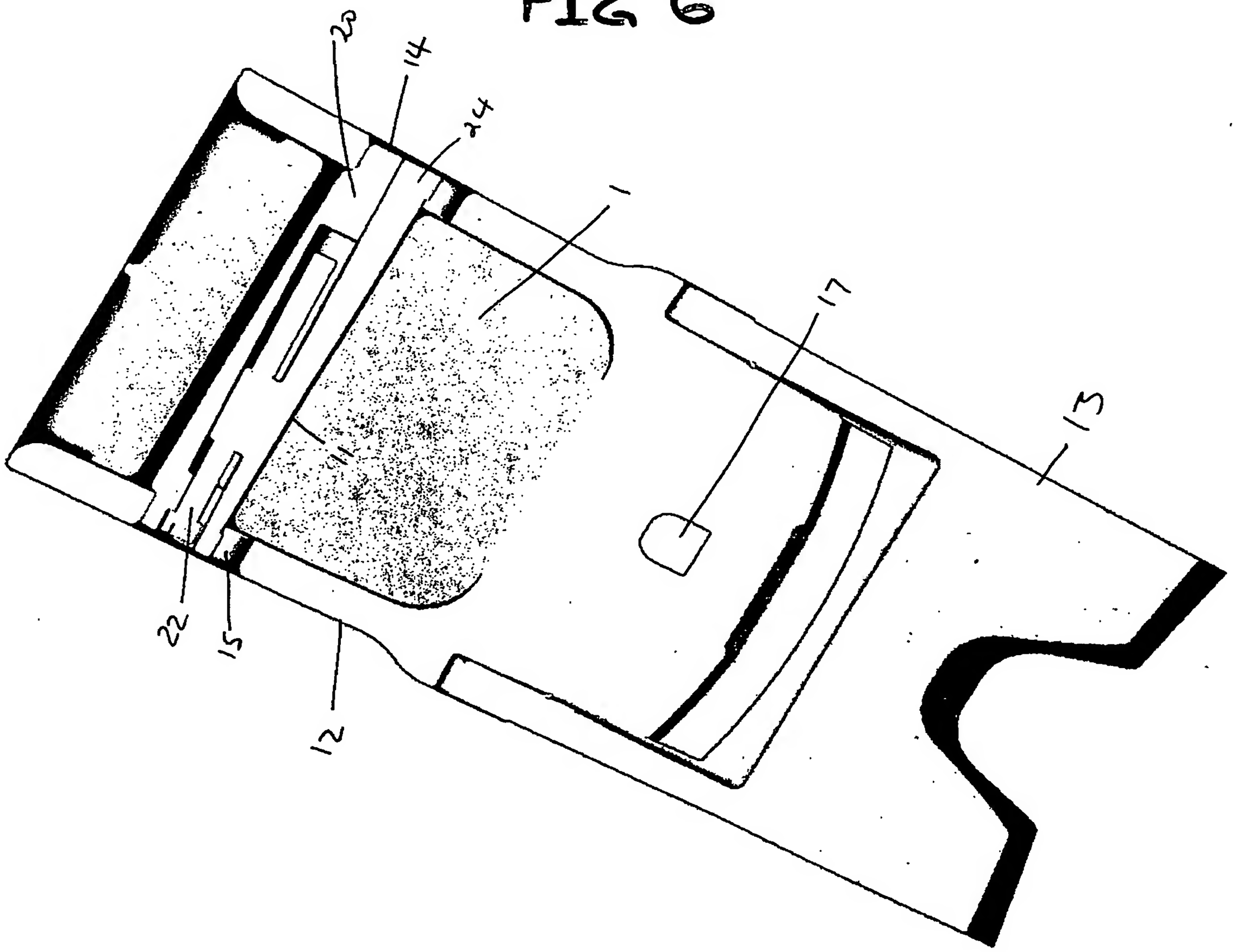

FIG 7

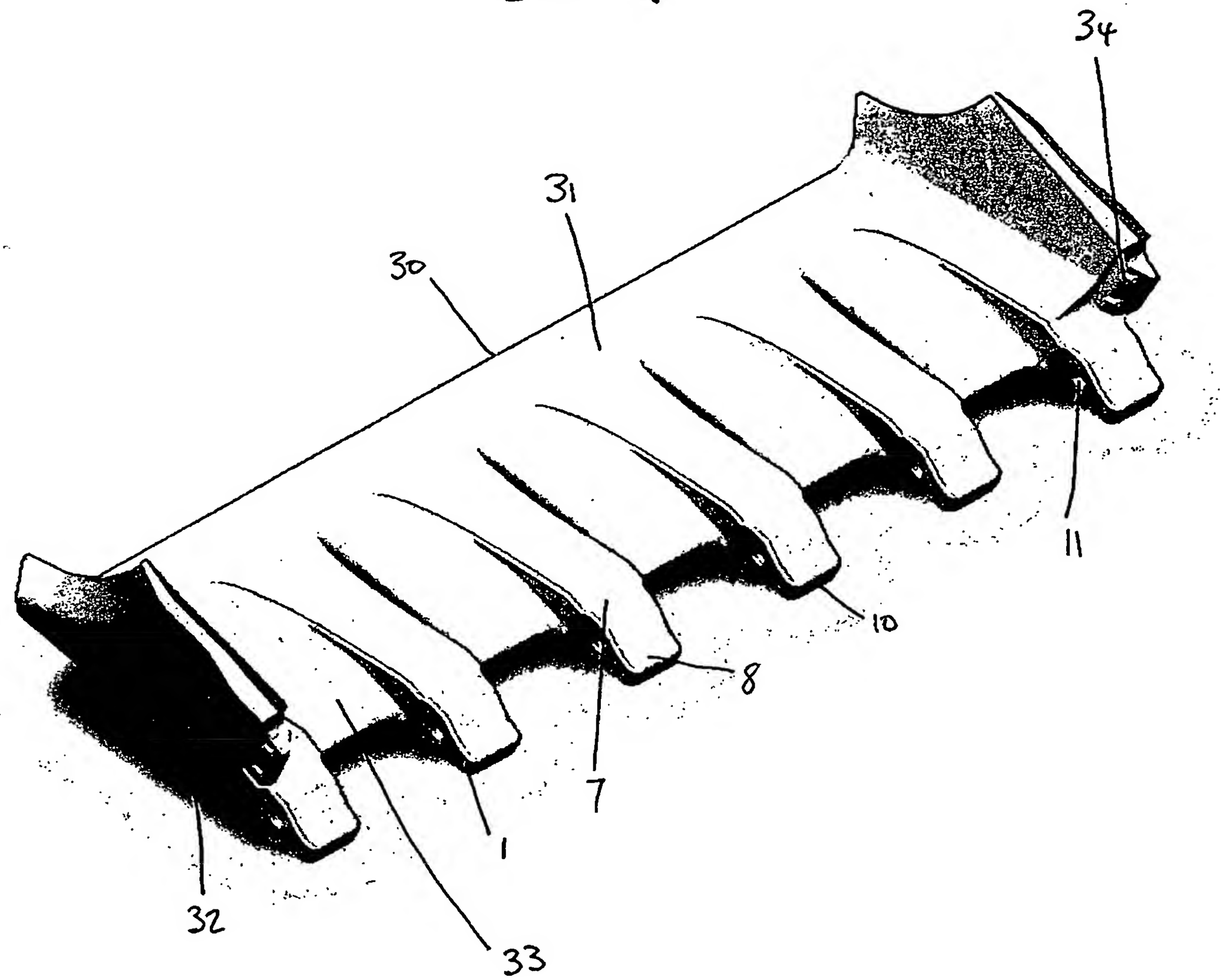

FIG 8

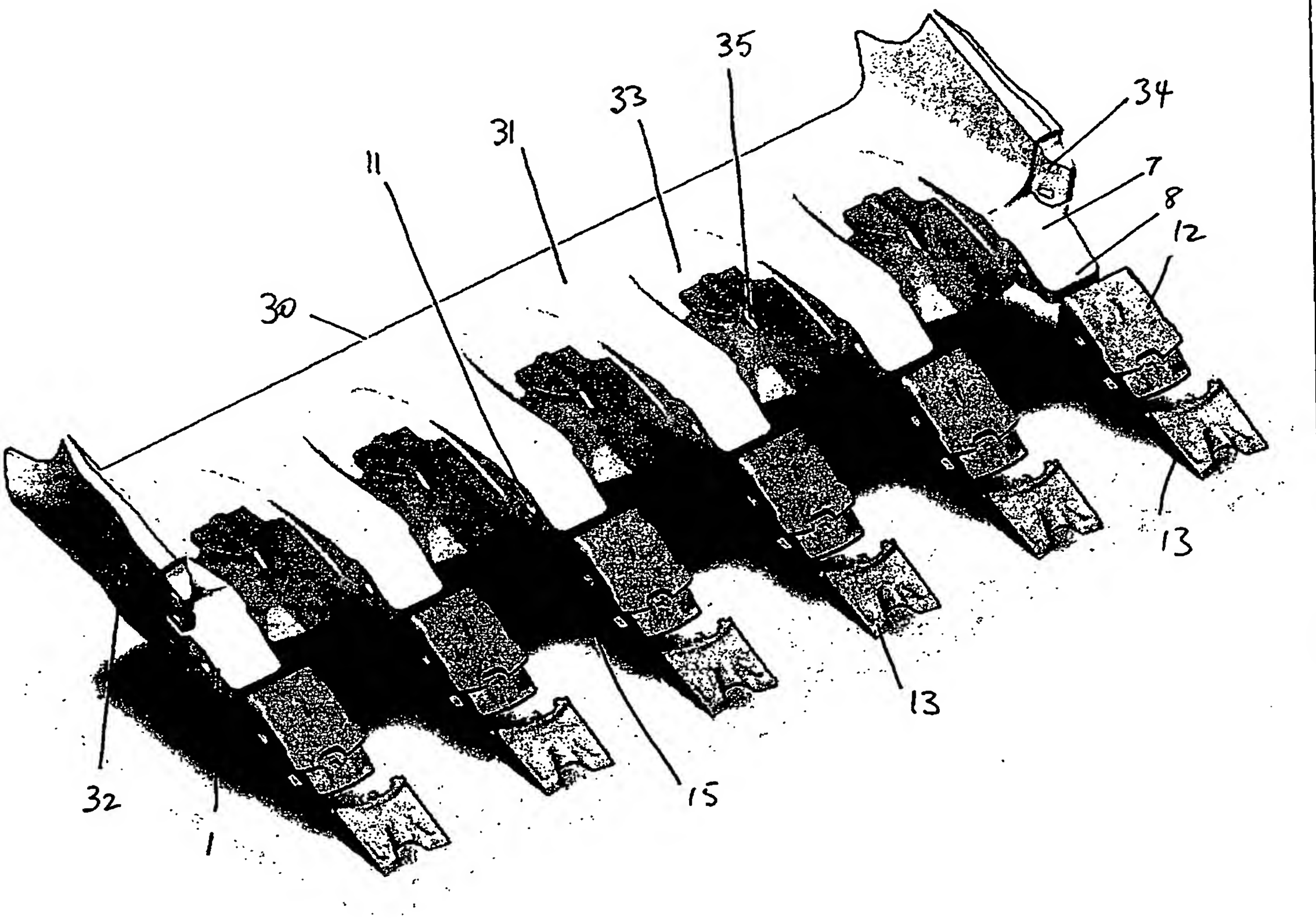

FIG 9